





The background of the page features a faded, high-contrast image of three soldiers in full CBRN (Chemical, Biological, Radiological, and Nuclear) protective gear. They are standing in front of a brick building with a satellite dish on the roof. The image is desaturated and has a grainy, artistic quality.

# CBRN Survivability

## Is Your Program Ready?

*Jorge Hernandez ■ Mike Kotzian ■ Duane Mallicoat*

**T**he insidious threat posed by chemical, biological, radiological, and nuclear (CBRN) weapons has significantly changed how U.S., allied, and coalition forces must now prepare for joint operations. CBRN survivability has become a game-changer in a way that no other threat has. To formalize the growing importance of this capability, the DoD modified an existing policy (DoD Instruction 5000.02, Operation of the Defense Acquisition System) and developed a new policy (DoD Instruction 3150.09, The CBRN Survivability Policy) to better ensure that program offices address CBRN defense requirements as early as possible in a weapon system's acquisition life cycle. These policies provide top-level guidance for weapon systems that are expected to survive and execute missions in a CBRN environment.

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When compared with some of the other weapon system requirements that a program manager (PM) might consider to be more “high-profile,” CBRN survivability and force protection have been viewed by some as less than totally successful in getting the necessary resources to better assure the inclusion of a CBRN capability in a weapon system’s design. One outcome of such an approach is that many times CBRN defense solutions are handled as an afterthought and belatedly are required to be designed and integrated into an existing platform as a retrofit program. The impact is that the trade-space for most CBRN defense solutions becomes very limited later in a program’s development life cycle, thereby creating higher development, production, integration, and supportability costs of the CBRN defense equipment, and sometimes forcing PMs to severely compromise the CBRN defense requirement. This typically results in a decreased capability to the warfighter and/or overall higher life cycle costs.

### **Meeting the Challenge**

In response to these challenges, the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD) established the Major Defense Acquisition Program (MDAP) CBRN Survivability Trail Boss Initiative in October 2009. The intent of this initiative is to enhance support to weapon system programs designated as DoD CBRN mission-critical and those requiring CBRN defense capabilities so the programs are better positioned to meet their entire set of CBRN survivability and force-protection requirements. The MDAP Trail Boss Initiative supports programs of all acquisition categories (ACATs), as well as non-DoD agencies, such as the Department of Homeland Security.

The initiative offers weapon system program offices a single point of contact to help facilitate the research, development, test and evaluation (T&E), procurement, delivery, and life cycle sustainment of affordable CBRN defense materiel solutions that meet the program’s documented requirements. In doing so, the MDAP Trail Boss works closely with organizations internal and external to the JPEO-CBD to provide the weapon system program with a comprehensive CBRN defense solution. This methodology is envisioned to reduce

the burden on weapon system programs by providing a “one-stop-shopping” philosophy to address all of a program’s CBRN survivability requirements.

Additionally, this initiative offers program offices a subject matter expert (SME) resource that can be used throughout a weapon system’s acquisition life cycle. This ensures that the CBRN survivability trade-space is maximized and developed in conjunction with other aspects of the weapon system platform, thereby providing a holistic, effective, and affordable solution.

### **Driving the CBRN Defense Herd**

It was immediately recognized that the MDAP Trail Boss could not accomplish the initiative’s objectives alone. Therefore, the resource commitment was made to assemble an MDAP Trail Boss Team, which is divided into five product areas, each led by a designated platform manager. The platform manager provides the day-to-day coordination and management of all activities required to meet a weapon system program’s CBRN survivability needs. The five product areas are:

- Ground Mobile (e.g., tanks, infantry fighting vehicles, armored personnel carriers, tactical vehicles)
- Ships (e.g., destroyers, frigates, command ships, aircraft carriers)
- Aircraft (e.g. fixed-wing and rotary aircraft)
- Transportable (e.g., tents, transportable shelters, and individual gear worn or carried by the warfighter)
- Fixed site (e.g., permanent and semi-permanent buildings and structures)

In addition to the platform manager, the MDAP Trail Boss Team consists of representatives from the systems engineering, logistics, T&E, science and technology (S&T), and modeling and simulation (M&S) functional disciplines. These functional representatives support the five product areas, when needed, and are drawn from the following five JPEO-CBD joint project managers (JPMs) to ensure that a comprehensive evaluation of a system’s CBRN survivability requirements is addressed:

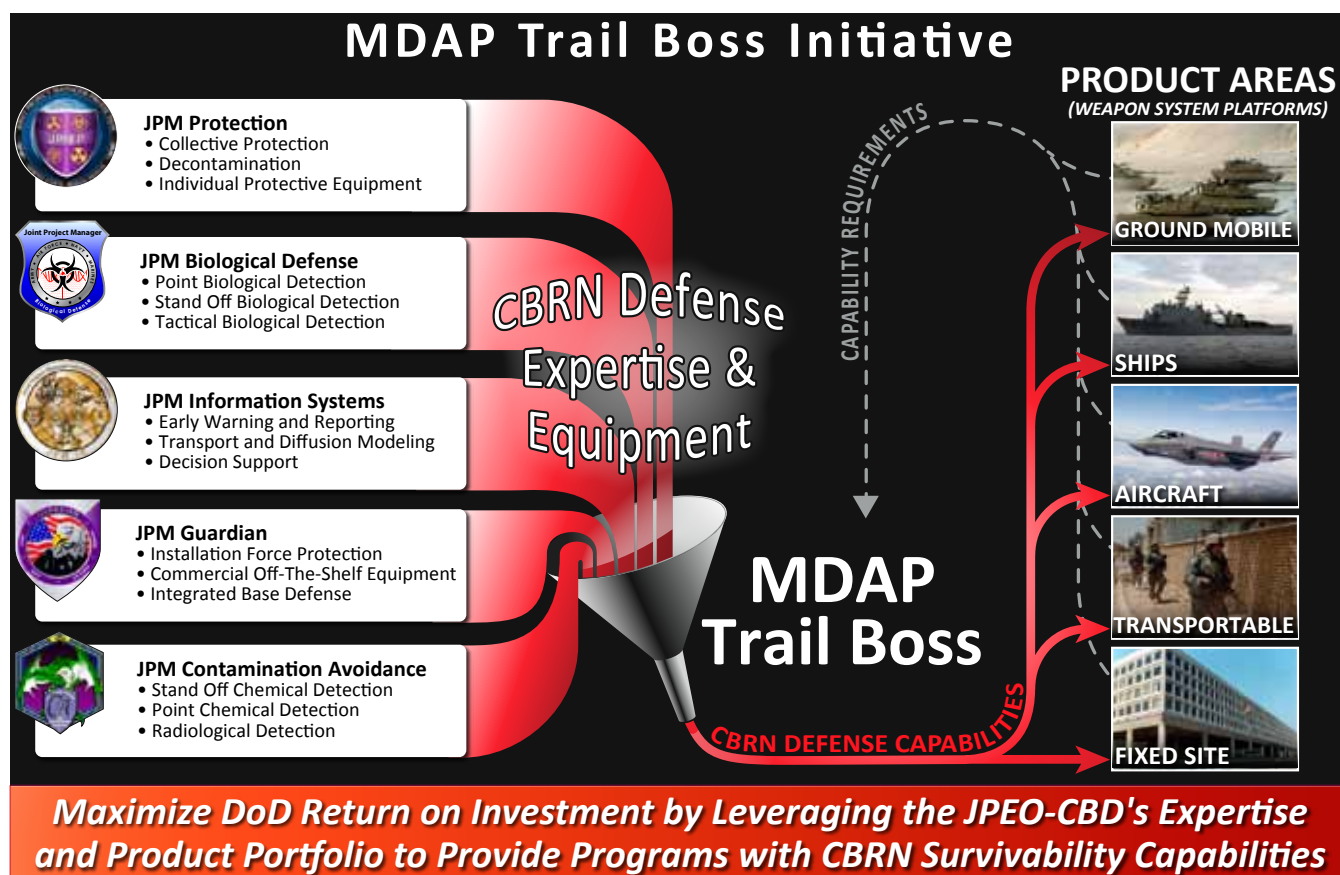
- JPM for biological defense (JPM BD): materiel solutions that detect, identify, warn, deter, and defeat biological threats
- JPM for information systems (JPM IS): integrated early warning capabilities, accredited hazard prediction models, and state-of-the-art consequence management, and course-of-action analysis tools
- JPM guardian: detection, analysis, communications, protection, response, and survey capabilities in support of installation force protection, civil support teams (CST), reserve reconnaissance and decontamination platoons, tactical units, and civil authorities
- JPM for nuclear, biological, and chemical contamination avoidance (JPM NBC CA): materiel solutions that detect, identify, warn, deter, and defeat biological, chemical, and radiological threats
- JPM for protection (JPM P):
  - Collective Protection (ColPro) equipment and systems that protect personnel and equipment within protected areas from chemical, biological, radiological, and toxic industrial materials
  - Decontamination systems, including the decontaminant and applicator
  - Individual Protection Equipment (IPE) that provides percutaneous (through the skin), inhalation, and ocular (eye) protection against chemical and biological threats

- Provisional JPM for radiological and nuclear defense (JPM RND): materiel solutions to counter radiological and nuclear threats

An overview of the JPEO-CBD “players” associated with the MDAP Trail Boss Initiative is depicted as follows:

In January 2011, the JPEO-CBD designated William Hartzell, the JPM P, to lead the MDAP Trail Boss Initiative in conjunction with his JPM P management activities. He summarized this new initiative as a way to “reach out to help all product and project managers meet their CBRN survivability requirements. We give program executive offices (PEOs) and PMs a ‘one-stop shop’ for *systems engineering, requirements realism, tactics, techniques, and procedures* (TTPs), and membership across all CBRN product areas. It is much easier to engage us early-on, prior to Milestone B, so we can assist you in meeting your requirements. It becomes time-consuming and expensive to backward integrate after Low Rate Initial Production (LRIP). So the upfront and early approach really applies here.”

Early engagement is focused on implementing a sound systems engineering process throughout an acquisition program, which allows the MDAP Trail Boss Initiative to help minimize total life cycle costs, reduce schedules, and maximize performance.





## A Two-Phased Process

When it comes to actual implementation of the MDAP Trail Boss Initiative, a process tailored to each customer is used to meet the needs of individual weapon system programs. Typically, the support process consists of two phases, each designed to reduce the burden on weapon system programs.

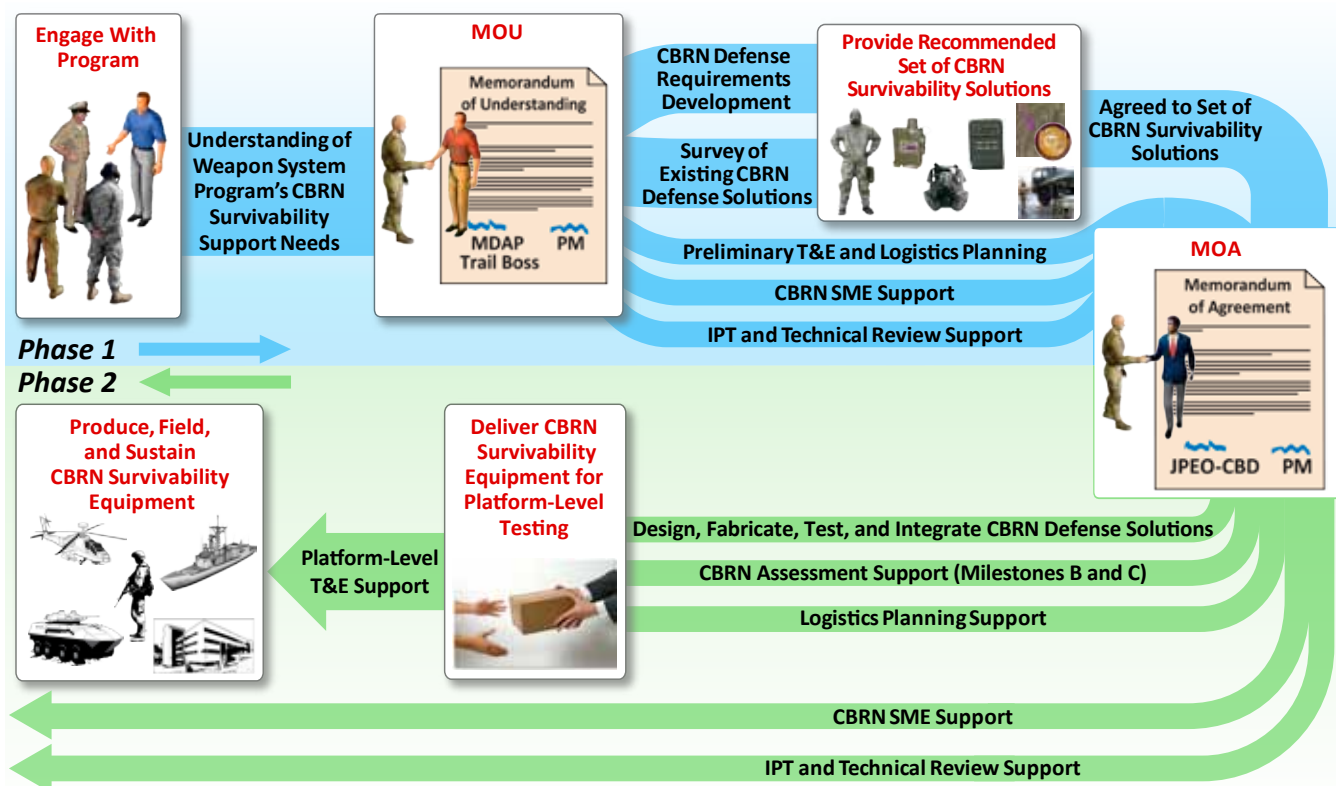
The first phase consists of all activities necessary to identify the appropriate set of CBRN defense solutions needed to satisfy the weapon system program's survivability and force protection requirements. This phase begins with the appropriate platform manager engaging with the weapon system program to establish the level of required CBRN support. Any agreed roles and responsibilities, schedules, and deliverables are documented in a Memorandum of Understanding that may typically involve some or all of the following:

- Providing CBRN SME support
- Performing systems engineering analyses to develop CBRN-specific operational and technical requirements
- Performing systems engineering analyses to develop recommended CBRN-specific requirements for inclusion in the program's Capabilities Development Document (CDD) and/or the Capabilities Production Document (CPD)
- Identifying existing CBRN materiel solutions to best meet documented requirements
- Identifying performance gaps between existing materiel and technical requirements

- Performing trade-space analyses to optimize CBRN survivability capabilities within cost and schedule constraints
- Development of cost and schedule estimates to remedy identified gaps
- Helping develop tactics, techniques, and procedures to address identified gaps
- Identifying, assessing, and tracking risks
- Conducting preliminary CBRN T&E and logistics planning
- Development of CBRN defense architectures products

The second phase consists of all activities required to design, fabricate, integrate, test, field, and/or sustain the entire set of CBRN defense solutions. The MDAP Trail Boss' support during this phase is tailored to accommodate the weapon system program's cost, schedule, and performance requirements, and can range anywhere from basic on-call CBRN SME support to full CBRN materiel acquisition support. A Memorandum of Agreement identifies the agreed-to roles and responsibilities, schedules, and deliverables that may typically include some or all of the following:

- Development of the program's CBRN Assessment, required by DoDI 5000.02 and DoDI 3150.09 for Milestone B and C reviews
- Development, delivery, and sustainment of CBRN materiel solutions
- Providing CBRN T&E, logistics, and M&S support
- Providing integration and platform-level T&E support



**MDAP Support Process, Tailored to Meet the Program's Needs**

- Supporting relevant technical, programmatic, and milestone reviews
- Participation in relevant Integrated Product Teams (IPTs)
- Refining requirements and architectures developed in the first phase
- Providing CBRN SME support

There is no “typical” length of time associated with either of these phases. The intent is that the MDAP Trail Boss Team will work with the customer, who is the weapon system manager, to negotiate the level of involvement, deadlines, deliverables, etc., in a manner that supports the customer’s expectations and requirements. In the same vein, the costs associated with involving the MDAP Trail Boss Team will need to be negotiated on a customer-by-customer basis based on the level of support being requested.

### Real-World Benefits

While the MDAP Trail Boss Initiative may sound like a wonderful idea, many PMs could have a somewhat reserved opinion of yet another requirement. So is the MDAP Trail Boss Initiative worthwhile? As an example of the benefits of this relatively young initiative, the Joint Strike Fighter (JSF) program, which has overall responsibility for developing and fielding the F-35 Lightning II stealth aircraft, stands out.

The MDAP Trail Boss Team has been working closely with JSF to meet the program’s chemical and biological (CB) survivability and pilot protection requirements. The JSF Operational Requirements Document (ORD) requires that the aircraft must be designed to facilitate pilot survivability and must facilitate decontamination when exposed to CB agents. Additionally, the Joint Requirements Oversight Council (JROC) mandated pilot CB protection as part of the JSF survivability and force protection key performance parameters (KPPs). To address these critical requirements, the MDAP Trail Boss Team and its partners are developing a CB flight respirator and a comprehensive aircraft decontamination system.



The flight respirator requirement will protect pilots against chemical and biological warfare agents.

The flight respirator requirement for the JSF program provides pilot protection (head, eye, respiratory, and percutaneous) against CB warfare agents, while maintaining hypoxia and anti-gravity protection necessary for F-35 pilots. In order to deliver an affordable, low-risk flight respirator solution, the MDAP Trail Boss Team, in conjunction with JPM P’s Respirator Product Directorate and Gentex Corp., is leveraging work in progress on JPM P’s existing joint service aircrew mask (JSAM) fixed-wing (FW) variant acquisition program. The JSAM FW respirator is being modified to meet the JSF’s unique requirements such as integration with the F-35’s pilot interface connector, pilot’s helmet and personalized liner, helmet-mounted display, below-

the-neck pilot flight equipment ensemble, and crush-proof hoses. The new JSF-specific respirator being delivered for the JSF LRIP decision is called the JSAM-JSF Variant.

In addition, the MDAP Trail Boss Team, in conjunction with JPM P’s Protection and Hazard Mitigation Product Directorate, HDT Global, Production Products, and STERIS Corp., is developing a comprehensive aircraft decontamination system that allows the F-35 aircraft to be “cleaned” and safely returned to operation after CB contamination. This reduces or eliminates the impact of CB warfare hazards on the ability of the United States and its allies to execute required missions. As with the CB flight respirator, the MDAP Trail Boss Team is leveraging JPEO-CBD programs and other efforts to provide an affordable, low-risk aircraft decontamination solution. Existing shelter, collective protection, and decontaminant delivery technologies are being matured and integrated in new ways to provide simultaneous internal and external decontamination of the aircraft.

The JSF decontamination system is composed of an air beam shelter (with an incorporated CB containment liner structure) and an integrated decontaminant delivery system, providing hot air decontamination and biothermal decontamination capabilities for decontaminating CB agents, respectively. After contamination, the F-35 is positioned inside the lined shelter and the appropriate decontaminant is applied.

Negative pressure is applied inside the shelter to prevent any CB agents from escaping to the outside environment. Once the decontamination process is complete, the aircraft can be serviced (if needed) or flown on a mission.

The successful design, integration, and testing of JSF CB defense capabilities is only possible through close, coordinated activities between JSF and the MDAP Trail Boss Team.

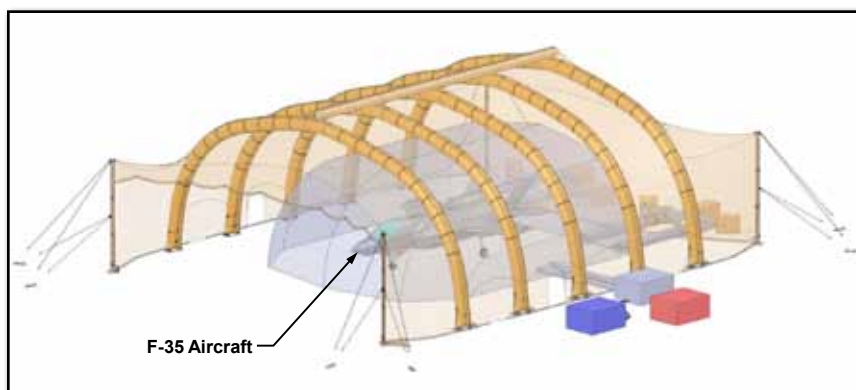
William Dooley, the JSF Mission Effectiveness Integrated Product Team Lead, says, "The JSF will be the first tactical jet aircraft with a comprehensive chem-bio pilot protection key performance parameter (KPP) and an aircraft decontamination requirement. Developing and demonstrating these capabilities is only possible through the outstanding, cooperative and fully integrated development activity currently being executed through the MDAP Trail Boss Initiative. Fielding a system that provides this capability will be a true testament to the commitment, dedication, and technical expertise of the design engineers across all the disciplines."

## Our Team Stands Ready

As the potential of a CBRN attack looms over the development of DoD systems to counter asymmetric and traditional threats, the MDAP Trail Boss Initiative stands ready to support DoD program office CBRN priorities and requirements. In the words of the current Joint Program Executive Officer for Chemical and Biological Defense, Brig. Gen. Jess Scarbrough, USA, "I view the MDAP Trail Boss Initiative as a key component of this organization. By undertaking this initiative, the JPEO-CBD will be positioned to ensure our Warfighters receive the most technically advanced CBRN defense capabilities in a cost-effective and timely manner."

A multitude of requirements simultaneously seeks attention and resources from a PM and the program's team. For programs with CBRN survivability requirements, engaging the MDAP Trail Boss Team when the program's CDD is being developed will maximize the benefits to the program. This important resource complements warfighter protection and further enhances mission success. &

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Left: Joint Strike Fighter Decontamination System Architecture (computer model)

Below: The Aircraft Decontamination System in the open position.

